WHAT IS CLAIMED IS:

1. A disc drive, comprising:

a disa pack;

- an actuator with an actuator position controllable by a control signal u;
 - a read/write head coupled to the disc pack and the actuator and providing a signal representing a sensed actuator position " θ ":
- a controller circuit receiving the signal representing the sensed actuator position " θ " and adapted to receive reference data indicating a desired actuator position " θ _d" and adapted to store adaptive parameter data " \hat{A} ", the controller circuit generating the output u derived from the formula:

$$\hat{A}\left(\ddot{\theta}_d + 2\lambda\dot{e} + \lambda^2e\right) + k\left(\dot{e} + 2\lambda e + \lambda^2\int_0^t ed\tau\right)$$

- in which " λ " is a controller zero value, "k" is a controller gain value, "t" is time, and "e" is a difference between the desired actuator position θ_d and the sensed actuator position " θ ".
- 20 2. The disc drive of Claim 1, wherein the controller gain "k" is in the range of:

$$k > \frac{\lambda A}{2}$$

and A is a selected nominal fixed value corresponding with a range of actuator gains.

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3. The disc drive of Claim 1 further comprising: an adaptive system generating the adaptive parameter data "Â" according to an update equation: $\widehat{A} = \widehat{e_1e_2}$.

4. The disc drive of Claim 3 wherein the adaptive system generates the adaptive parameter data "Â" according to the formula:

$$\widetilde{A} = \left(\ddot{\theta_d} + 2\lambda \dot{e} + \lambda^2 e \right) \left(\dot{e} + 2\lambda e + \lambda^2 \int_0^t e d\tau \right)$$

- 5. The disc drive of Claim 1 wherein the controller circuit is a discrete controller.
 - 6. The disc drive of Claim 5 wherein the output "u" comprises a controlled electric current supplied to the actuator.
- 7. The disc drive of Claim 6 wherein the controlled electric current is controlled by pulse width modulation.
 - 8. The disc drive of Claim 6 wherein the controller circuit further comprises a digital-to-analog converter providing the controlled electric current.
 - 9. The disc drive of Claim 6 wherein the read/write head reads the sensed actuator position θ from the disc pack.
- 25 10. A disc drive with a circuit adapted to control an actuator position, comprising:

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a first controller input adapted to receive reference data indicating a desired actuator position " θ_d ";

- a second controller input adapted to receive error data indicating a difference "e" between a desired actuator position and a sensed actuator position " θ ";
- a third controller input adapted to receive adaptive parameter data \hat{A}'' ;
- a controller output "u" adapted to provide a control signal to the actuator; and
- a first controller circuit that receives the first and third controller inputs and calculates a first partial controller output G3(s) as a function thereof;
 - means coupled to the second and third controller inputs for deriving a second partial controller output G1(s) + G2(s) according to the transform formula

$$\frac{(k+2)A(s^2+(2\lambda k+\lambda^2 A)s+k\lambda^2}{s}$$

in which " λ " is a controller zero value and "k" is a controller gain value and "s" is the Laplace transform variable; and a summing circuit that combines the first partial controller output G3(s) and the second partial controller output G1(s) + G2(s) and provides the controller output U(s) = G1(s) + G2(s) + G3(s).

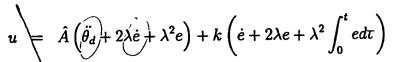
11. The disc drive of Claim10 wherein the second controller circuit is stable as defined by the Routh stability criteria.

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- 12. The disc drive of Claim 10 wherein the calculations in the first and second controllers are calculated according to an error model.
- 13. The disc drive of Claim 10 wherein the read/write head reads the
 5 sensed actuator position θ from the disc pack.
 - 14. A method of controlling an actuator position in a disc drive, comprising:
 - (a) acquiring and storing current: (Nth) updates of a position error signal e and a setpoint θ_d in a memory;
 - (b) making current (Nth) and past ((N-1)th, (N-2)th) values of error signal e, estimate \hat{A}^{j} and setpoint θ_{d} available for real time calculation by retrieving them from memory;
 - (c) digitally calculating a first derivative of error signal e, an integral of error signal e, and a second derivative of setpoint θ_d using the values retrieved in step (b) above;
 - (d) adaptively updating the parameter estimate and calculating an updated controller output u by using the derivative and integrals calculated in step (d) above and adaptive parameter data Â; and
 - (e). iteratively repeating steps (a), (b), (c) and (d) above in real time in a discrete controller.
- 25 15. The method of Claim 14 wherein the controller output u is controlled according to the equation:



in which " λ " is a controller zero value and "k" is a controller gain value and "t" is time.

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16. The method of Claim 15 wherein the adaptive parameter data is updated according to the formula

$$\widetilde{A} = \left(\ddot{\theta_d} + 2\lambda \dot{e} + \lambda^2 \dot{e} \right) \left(\dot{e} + 2\lambda e + \lambda^2 \int_0^t e d\tau \right)$$

17. The method of Claim 16 wherein the update of adaptive parameter data is updated digitally in real time using instructions stored in a computer readable program storage device.

18. The method of Claim 14 wherein the actuator is a voice coil motor in a disc drive.

